EXHIBIT A

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

GOOGLE LLC, Plaintiff/Counterclaim Defendant, v. ECOFACTOR, INC., Defendant/Counterclaim Plaintiff.	Case No. 4:21-cv-03220-HSG **JURY TRIAL DEMANDED**

Expert Report of Robert Zeidman Regarding Claim Construction

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I. INTRODUCTION

1. I have been retained as an expert in the above-captioned case by counsel for EcoFactor, Inc. ("EcoFactor"). I understand that the parties dispute the meaning of certain claim terms. I have studied the intrinsic and relevant extrinsic evidence pertaining to those terms. In this report, I provide my opinions regarding how one of ordinary skill in the relevant art would understand each term.

2. As of the time of this report, Google has not identified any extrinsic evidence supporting its proposed constructions, including no expert testimony. Should Google provide such information in the future, I reserve the right to supplement my analysis accordingly. As of the time of this report, Google has also provided very little detail about its positions, especially those relating to indefiniteness. I reserve the right to supplement my analysis once Google and any expert upon which it may rely provide further information regarding its indefiniteness arguments and proposed constructions.

II. QUALIFICATIONS

3. I am an engineer and the founder and president of Zeidman Consulting, which provides engineering consulting to high-tech companies. Among the types of services I provide are hardware and software design. My clients have included Fortune 500 computer and technology companies as well as smaller companies and startups. A copy of my resume is attached hereto as Exhibit A.

4. I hold a master's degree from Stanford University in Electrical Engineering and two bachelor's degrees from Cornell University, one in Electrical Engineering and one in Physics.

5. I have been a computer software and hardware designer for over 40 years, having designed and developed a variety of computer hardware and software. The software products include Internet-based training courses and web-based course administration software, an operating system synthesis tool, a source code comparison tool, a network emulation software bridge, and a remote backup system. I have founded several companies including Zeidman

Consulting, a hardware and software development firm, eVault, a remote backup company, the Chalkboard Network, an e-learning company, Zeidman Technologies that develops software tools for enabling and improving hardware and software development, Software Analysis and Forensic Engineering Corporation that develops software forensic analysis tools, and Good Beat Poker, an online interactive gaming company.

6. For several decades, I have been designing, writing about, and teaching about embedded systems that comprise controllers like the ones described in the patents at issue in this matter. For many years, I taught courses on embedded systems at the Embedded Systems conferences throughout the world. I have designed hardware and software for these kinds of controllers into devices at Apple, Cisco, and Ricoh, among others. I was the founder of Zeidman Technologies that created tools for Internet of Things (IoT) devices to control and monitor signals and communicate with the Internet. Zeidman Technologies was named one of the 2016 "Cool Vendors in IoT 'Thingification'" (https://www.gartner.com/doc/3311335/cool-vendors-iot-thingification-) by Gartner. Zeidman Technologies had a contract to develop energy monitoring devices in partnership with CURB (https://energycurb.com) for use and resale by Schneider Electric.

7. I have written a variety of papers, books, and presentations on computer hardware and software and other engineering subjects. I am the developer of the Universal Design Methodology, a process for efficiently developing reliable systems, about which I have written extensively.

8. I hold 23 patents in the areas of software analysis, software comparison, software synthesis, hardware emulation, hardware synthesis, hardware simulation, and media broadcast and advertising. I wrote a textbook on software forensics entitled *The Software IP Detective's Handbook, Measurement, Comparison, and Infringement Detection*, which is recognized as the seminal book in the field. I have created a tool called CodeSuite® for assisting in the determination of whether one computer program has been copied from another computer program.

9. I have consulted on over 250 matters involving intellectual property disputes

including instances of alleged software copying, trade secret misappropriation, and patent infringement. My work in this capacity has included, among other things, reviewing and analyzing software source code, reviewing and analyzing patents, reverse engineering hardware and software, writing expert reports, and testifying in court. I have testified at deposition and at trial in a number of these cases, including in other cases involving EcoFactor patents and subject matter technically similar to the subject matter here. The specific cases can be found in my resume, attached as Exhibit A.

III. MATERIALS CONSIDERED FOR THIS REPORT

10. In forming my opinion, I have reviewed, considered, and/or had access to the patent specifications and claims, their prosecution histories, the parties' preliminary claim construction disclosures and extrinsic evidence, and the materials cited in this report. I have also relied on my professional experience. I reserve the right to consider additional documents as I become aware of them and to revise my opinions accordingly.

IV. UNDERSTANDING OF LEGAL PRINCIPLES

11. I understand that a claim construction inquiry begins and ends in all cases with the actual words of the claim. Apart from the written description and the prosecution history, the claims themselves provide substantial guidance as to the meaning of particular terms. I further understand that the context in which a term is used in the asserted claim can be highly instructive. The patent specification can also shed light on the meaning of claim terms.

12. I understand that, when conducting a claim construction inquiry, courts are not required to construe every limitation present in a patent's asserted claims. I further understand that where a term is used in accordance with its plain meaning, the court should not re-characterize it using different language.

13. I understand that there is a "heavy presumption" that claim terms carry their full ordinary and customary meaning unless the accused infringer can show that the patentee expressly relinquished claim scope. The ordinary and customary meaning of a claim term is the meaning that

the term would have to a person of ordinary skill in the art at the time of the invention. Thus, the task of comprehending the claims often involves little more than the application of the widely accepted meaning of commonly understood words.

14. I understand that without clear and unambiguous disclaimer, courts do not import limitations into claims from examples or embodiments appearing only in a patent's written description, even when a specification describes very specific embodiments of the invention or even only a single embodiment. Similarly, statements during patent prosecution do not limit the claims unless the statement is a clear and unambiguous disavowal of claim scope.

15. I understand that Respondents bear the burden of proving that a claim is indefinite by clear and convincing evidence. I understand that a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. I understand that numerical precision is not required for patent claims and that terms of degree are permissible in patent claims.

16. I understand that, under 35 U.S.C. §112 ¶6, "[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. §112 ¶6. I understand that the standard for determining whether §112 ¶6 applies is whether the words of the claim are understood by persons of ordinary skill in the art to have a sufficiently definite meaning as the name for structure. Where a claim term lacks the word "means," there is a presumption that §112 ¶6 does not apply. To rebut this presumption, the challenger must demonstrate that the claim term fails to recite sufficiently definite structure or else recites function without reciting sufficient structure for performing that function. I understand this presumption cannot be overcome without a showing that the claim limitation is devoid of anything that can be construed as a structure.

V. BACKGROUND OF THE PATENTED TECHNOLOGIES

17. The four asserted patents are U.S. Patent Nos. 8,740,100 (the "'100 patent"); 8,751,186 (the "'186 patent"); 9,194,597 (the "'597 patent"); and 10,584,890 (the "'890 patent").

A. THE '100 PATENT

18. The '100 patent is entitled "System, Method and Apparatus for Dynamically Variable Compressor Delay in Thermostat to Reduce Energy Consumption" and claims priority to a provisional patent application filed on May 11, 2009.

19. The '100 patent describes a number of challenges addressed by the claimed invention. For example, the patent explains the use of compressor delays and problems associated with prior art approaches:

> As this effect became better understood and was designed into thermostats, it became a standard design feature. The hysteresis band or dead zone is now commonly designed to hold the desired setpoint within a range of +/−1 degree Fahrenheit. So, for example, if the heating setpoint is 68 degrees F., the furnace will turn on when the inside temperature as sensed by the thermostat falls to 67 degrees F., and will turn off again when the inside temperature as sensed by the thermostat reaches 69 degrees F. Thus the inside temperature is allowed to oscillate within a range of two degrees F.
>
> When residential refrigerant-based air conditioners became widely available in the 1950s, the same kinds of thermostats were used to control them as well. The need for a means to preventing rapid cycling is even more important for refrigerant-based systems is even more critical because there is a risk of significant physical damage to a compressor if it is turned on too soon after being turned off—if the refrigerant inside the compressor is still in liquid (and thus uncompressable) form when the compressor restarts, expensive mechanical failures are possible.
>
> Electronic thermostats have been available for more than 20 years. Many of these are also programmable. In general, these thermostats no longer use mechanical systems to sense temperature, relying instead on electrical devices such as thermistors or thermal diodes. Switching of the HVAC system is accomplished with solenoids or relays triggered by logic circuits in microprocessors. With such systems, adjustability of the hysteresis band is relatively simple, at least in theory. However, most systems do not allow direct access to this parameter. And the hysteresis band only protects the system against rapid automatic cycling. The hysteresis band will not prevent a user from rapidly changing settings, which can cause the damage discussed above.

> The way most electronic systems approach this problem is to enforce, via the electronic circuitry, a compressor delay—that is, whenever the compressor is switched off, the thermostat prevents it from restarting for a set interval, usual in the range of two to five minutes or so. (Some air conditioners may have an additional fail-safe delay in series with any circuitry in the thermostat as well.)
>
> Many programmable thermostats include mechanical switches to allow the installer or user to adjust the compressor delay for the system. But because it is generally expected that the installer of the system will set this parameter once based upon the requirements of the specific air conditioner being controlled, these mechanical switches are generally not accessible to the user from outside the unit. Changing the compressor delay generally requires disassembling the thermostat.
>
> * * *
>
> One specific pattern that has been validated is (in the case of heating) to allow the temperature to drift 2 degrees below the user's chosen setpoint over an extended period of 1-2 hours, and to then revert as quickly as possible to the originally desired setpoint. Because the slow cooling is not easily perceived, but the rapid reheating is, the subjective impression is weighted toward comfort, despite the fact that the average setpoint over the period of the "waveform" is 1 degree lower than the desired setpoint. (The pattern is inverted in the case of air conditioning.)
>
> One approach to achieving the benefits of such a setpoint strategy is to specifically schedule each of the planned setpoint changes required to create such a thermal waveform. This approach requires some combination of significant local intelligence resident in the thermostat, a local computer capable of controlling the thermostat, and/or a remote server managing frequent setpoint changes on remote devices.

'100 patent at 1:18-3:35.

20. The specification further describes the use of hysteresis bands and compressor delays to prevent rapid cycling of HVAC equipment, including in the context of demand response. See, e.g., '100 patent at 3:61-5:45. The specification also describes the general environment and hardware elements used in embodiments of the inventions. See, e.g., '100 patent at 5:46-8:2, Figs. 1-5. And the specification teaches the graphing of various data used by the claimed inventions (e.g., inside temperature, outside temperature) and the relationship between inside temperature and outside temperature that allows for prediction of rates of change in inside temperature in response to outside temperature. See, e.g., '100 patent at 8:3-38, Figs. 6a, 6B. And finally, the specification describes how compressor delays may be selected for different scenarios, as well as the impacts of

such delays. See, e.g., ’100 patent at 8:39-9:47, Figs. 7, 8a, 8b, 8c.

B. THE ’186 PATENT

21. The ’186 patent is entitled “System and Method for Calculating the Thermal Mass of a Building” and claims priority to a provisional patent application filed on September 17, 2007, as well as to other later-filed applications.

22. The ’186 patent describes, among other things, determining strategies for pre-cooling a structure based on predicted rates of change in inside temperature in response to changes in outside temperature, including to reduce electricity demand during periods of expected high demand. For example, the specification explains:

> The cost to an electric utility to produce power varies over time. Indeed, the cost of production between low demand and peak demand periods can vary by as much as an order of magnitude. Traditionally, residential customers paid the same price regardless of time or the cost to produce. Thus consumers have had little financial incentive to reduce consumption during periods of high demand and high production cost. Many electric utilities are now seeking to bring various forms of variable rates to the retail energy markets. Under such schemes, consumers can reduce costs by taking into account not just how much energy they use, but when they use it.
>
> Thus many consumers now can see real benefits from optimizing not just the total number of kilowatt-hours of electricity consumed, but also optimizing when it is used. The optimum strategy for energy use over time will vary based upon many variables, one of which is the thermal mass of the structure being heated or cooled. In a structure with high thermal mass, heating and cooling can effectively be shifted away from high cost periods to lower cost “shoulder” periods with little or no effect on comfort. If, for example, a utility charges much higher rates on hot summer afternoons, it is likely that pre-cooling a high-thermal mass structure just before the high-cost period and then shutting down the air conditioning during the peak will allow the house to remain comfortable. But in a house with low thermal mass, the benefits of pre-cooling will quickly dissipate, and the house will rapidly become uncomfortable if the air conditioning is shut off. Thus it would be advantageous for a temperature control system to take thermal mass into account when setting desired temperatures.

’186 patent at 3:7-36.

> In addition to using the system to allow better signaling and control of the HVAC system, which relies primarily on communication running from the server to the thermostat, the bi-directional communication will also allow the thermostat 108 to

> regularly measure and send to the server information about the temperature in the building. By comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system, and other variables, the system will be capable of numerous diagnostic and controlling functions beyond those of a standard thermostat.

’186 patent at 8:21-30.

> Because the system will be able to calculate effective thermal mass, it will also be able to determine the cost effectiveness of strategies such as pre-cooling for specific houses under different conditions…the system will recommend that House A pre-cool in order to save money, but not recommend pre-cooling for House B [because of differences in thermal mass between House A and House B].

’186 patent at 9:45-10:5; see also, e.g., ’186 patent at Figs. 6A, 6B, 9A, 9B, and associated descriptions.

C. THE ’597 PATENT

23. The ’597 patent is entitled “System, Method and Apparatus for Identifying Manual Inputs to and Adaptive Programming of a Thermostat” and claims priority to a provisional patent application filed on May 12, 2009, as well as to another later-filed application.

24. The ’597 patent describes several problems associated with early programmable thermostats, including issues with aligning a user’s actual schedule with the schedule they have previously programmed, where a failure to align these two can result in wasted energy usage or reduced comfort. See, e.g., ’597 patent at 1:18-2:17. The specification also describes the general environment and hardware elements used in embodiments of the inventions. See, e.g., ’597 patent at 2:50-5:4, Figs. 1-5. And the specification teaches the graphing of various data used by the claimed inventions (e.g., inside temperature, outside temperature) and the relationship between inside temperature and outside temperature that allows for prediction of rates of change in inside temperature in response to outside temperature. See, e.g., ’597 patent at 5:5-53, Figs. 6A, 6B. The specification also describes aspects of the patented inventions via several flow diagrams and associated descriptions, including figures relating to detecting and/or incorporating manual changes to setpoints. See, e.g., ’597 patent at 5:54-7:43, Figs. 7-9.

D. THE ’890 PATENT

25. The ’890 patent is entitled “System and Method for Using a Mobile Electronic Device to Optimize an Energy Management System” and claims priority to a non-provisional patent application filed on May 26, 2010, as well as to other later-filed applications.

26. The ’890 patent describes various problems addressed by the claimed invention, including restrictive user interfaces, limited functionality, rapid cycling, and ineffective occupancy sensing. See, e.g., ’890 patent at 1:28-3:57. The specification provides extensive disclosure of the patented inventions, spanning over 30 columns of description and several dozen figures. The patent summarizes various embodiments of the invention at a high level (see ’890 patent at 3:61-5:17) and provides more detailed descriptions of various aspects of the patented technology (see ’890 patent at 6:66-33:6 and associated figures).

27. As particularly relevant to the claim construction disputes here, the specification describes problems associated with rapid cycling (sometimes referred to as “short cycling”) and how the inventions of the ’890 patent overcome those challenges. See, e.g., ’890 patent at 19:46-20:35, Figs. 20, 21a, 21b, 21c

VI. LEVEL OF ORDINARY SKILL IN THE ART

28. A person of ordinary skill in the art (“POSITA”) at the time of the invention would have had (1) a bachelor’s degree in engineering, computer science, or a comparable field of study, and (2) at least 2-3 years of professional experience in temperature controls, embedded control systems, electronic thermostats, or HVAC controls, building energy management and controls, or other similarly relevant industry experience. Additional relevant industry experience may compensate for lack of formal education or vice versa. I note that this framework is consistent with what ALJ Elliot found to be the appropriate level of ordinary skill in an ITC investigation involving other EcoFactor patents. See Ex. B (Inv. No. 337-TA-1258, Order No. 18, dated Sept. 1, 2021 (“1258 Markman Order”) at 7-8. I have considered this level of ordinary skill in forming my opinions regarding claim construction. I am not aware of Google proposing any different level of

ordinary skill applicable to the asserted patents.

VII. DISPUTED TERMS

A. "predict a rate of change of temperatures inside the structure" / "calculate one or more predicted rates of change in temperature at the first location" / "calculating… one or more predicted rates of change in temperature at the first location" / "predict changes in temperature inside the structure" ('100 patent, claims 1, 9; '186 patent, claims 1, 8; '597 patent, claims 1, 9, 17)

EcoFactor's Proposed Construction	Google's Proposed Construction
"rate of change" / "rate of change of temperatures inside the structure" / "rates of change in temperature": difference between inside temperature measurements divided by the span of time between the measurements Remainder of phrases or other phrases: No construction necessary; plain and ordinary meaning	calculate a future rate of change in temperature without using actual values that have been obtained currently or in the past

29. I agree with EcoFactor's proposal for these claim terms. In multiple cases involving EcoFactor patents, including another case involving the same patents asserted here (*EcoFactor, Inc. v. ecobee, Inc.*, Case No. 6:21-cv-00428-ADA (W.D. Tex.) ("the -00428 Texas Action")), the court has found and/or the parties have agreed that variants of "rate of change of temperatures inside the structure" means "difference between inside temperature measurements divided by the span of time between the measurements." See, e.g., Ex. C (EcoFactor/ecobee Joint Claim Construction Statement) at 1. I further understand that "rate of change in inside temperatures of the structure" was construed as "difference between inside temperature measurements divided by the span of time between the measurements" in *EcoFactor, Inc. v. Google LLC,* Case No. 6:20-cv-0075-ADA (W.D. Tex.) (the "-00075 Texas Action"), *EcoFactor, Inc. v. ecobee, Inc.,* Case No. 6:20-cv-00078-ADA (W.D. Tex.) (the "-00078 Texas Action"), and *EcoFactor, Inc. v. Vivint, Inc.,* Case No. 6:20-cv-00080-ADA (W.D. Tex.) (the "-00080 Texas Action").

30. The remaining terms and phrases identified by Google for construction have plain and ordinary meanings that do not require any further construction.

31. Beginning with the phrase "predict a rate of change of temperatures inside the

structure," the remainder of the phrase has a plain and ordinary meaning that does not require further construction because a POSITA understands the plain and ordinary meaning of the term "predict." A POSITA would understand that to "predict" means to forecast or anticipate what will occur in the future, including at a future time and/or over a duration of time in the future.

32. Likewise, as to the phrases "calculate one or more predicted rates of change in temperature at the first location" and "calculating … one or more predicted rates of change in temperature at the first location," the remaining terms in these phrases do not require further construction because a POSITA would understand the terms "calculate," "predicted," and "at the first location" to have plain and ordinary meanings. A POSITA would understand that to "predict" means to forecast or anticipate what will occur at a future time and/or over a duration of time in the future, and that a "predicted rate of change" is a rate of change that is forecasted or anticipated to occur in the future. A POSITA would also understand the plain and ordinary meaning of "calculate" to refer to determining the predicted rate of change mathematically. And a POSITA would understand the plain and ordinary meaning of "at the first location" to refer to the structure that is being conditioned by the HVAC system.

33. The phrase "predict changes in temperature inside the structure" also does not require any further construction because it has a plain and ordinary meaning. A POSITA would understand this phrase to refer to forecasting or anticipating what changes in temperature will occur over a duration of time in the future.

34. Google's proposed construction acknowledges that a prediction is about the future but improperly limits the scope of the phrase by restricting the inputs that may be used to calculate the prediction. Specifically, Google's proposed construction would exclude from the scope of the claim using actual values—current and past—as inputs to calculate the predicted rate of change.

35. I disagree with Google's proposed construction. Google's proposal is not consistent with a POSITA's understanding of this claim language. A POSITA would understand that using current or past values as an input to the calculation of the predicted rate of change is consistent with the plain and ordinary meaning of the claimed phrases. There is only the past, the present,

and the future. And while a POSITA understands that past and present values can be known and used as inputs to perform calculations, a POSITA also understands that we do not yet have future values, and we cannot know for certain what the future values will be—which is why we are making a prediction about the future. Accordingly, temperature data available to use in calculating a prediction would include current values or historical values that occurred in the past. Excluding these would appear to only leave future values as inputs—but a POSITA would not understand the plain and ordinary meaning of "predict" to require the exclusive use of unknown inputs and the rejection of known values as inputs to the calculation.

36. Google's proposed construction would also exclude preferred embodiments. For example, Google's proposed construction would exclude preferred embodiments that are disclosed to calculate a predicted rate of change using actual values that were obtained currently or in the past. These preferred embodiments involve generating a prediction for the future using a calculation based on the available historical data stored in the database.

37. Preferred embodiments in the '100 patent disclose generating a prediction for the future with a calculation that uses available historical data stored in the database.

38. The '100 patent discloses actual values obtained currently or in the past. '100 patent at 7:34-40. The values are stored in "temperature database 400." See '100 patent at Fig. 5.

39. The '100 patent, at 7:60-8:38, discloses "bi-directional communication will also allow the thermostat 108 to regularly measure and send to the server information about the temperature in the building. By comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system, and other variables, the system will be capable of numerous diagnostic and controlling functions beyond those of a standard thermostat…." This discloses historical values logged in the server's database. See '100 patent at Fig. 6 and accompanying text:

> "For example, FIG. 6a shows a graph of inside temperature, outside temperature and HVAC activity for a 24 hour period. When outside temperature 302 increases, inside temperature 304 follows, but with some delay because of the thermal mass of the building, unless the air conditioning 306 operates to counteract this effect.

> When the air conditioning turns on, the inside temperature stays constant (or rises at a much lower rate or even falls) despite the rising outside temperature. In this example, frequent and heavy use of the air conditioning results in only a very slight temperature increase inside of the house of 4 degrees, from 72 to 7 6 degrees, despite the increase in outside temperature from 80 to 100 degrees. FIG. 6b shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7 PM. As expected, the inside temperature 304a rises with increasing outside temperatures 302 for most of that period, reaching 88 degrees at 7 PM."

40. The '100 patent, at 7:60-8:38, discloses (emphasis added):

> "Because server 106 logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. **That performance data will allow the server 106 to calculate an effective thermal mass for each structure—that is, the speed with [which] the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.** The ability to predict the rate of change in inside temperature in a given house under varying conditions may be applied by in effect holding the desired future inside temperature as a constraint and using the ability to predict the rate of change to determine when the HVAC system must be turned on in order to reach the desired temperature at the desired time."

41. The '100 patent, at Figures 7-8 and the accompanying text at 8:39-9:47, discloses the use of stored data of actual values obtained currently or in the past to predict a rate of change of temperatures inside the structure in response to changes in outside temperatures.

42. Preferred embodiments in the '186 patent disclose generating a prediction for the future with a calculation that uses available historical data stored in the database. For example, the '186 patent, at 5:4-30, discloses that the "server logs the ambient temperature sensed by each thermostat vs. time and the signals sent by the thermostats to their HVAC systems. The server preferably also logs outside temperature and humidity data for the geographic locations for the buildings served by the connected HVAC systems." These are actual values obtained currently or in the past. The values are stored in "temperature database 400." See '186 patent at 7:62, Fig. 5.

43. The ’186 patent, at 8:21-45, discloses “comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system,” which are all historical values logged in the server’s database. *See* ’186 patent at Figs. 6-11, 8:31-63.

44. The ’186 patent, at 8:63-9:9, discloses that:

> “Because server 106a logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. **That performance data will allow the server 106a to calculate an effective thermal mass for each structure—that is, the speed with [which] the temperature inside a given building will change in response to changes in outside temperature and differences between inside and outside temperatures. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.**”

See also ’186 patent at Figs. 6-11.

45. The ’186 patent, at 10:57-11:19, discloses that at step 1106, the server “retrieves data regarding recent temperature readings as recorded by the thermostat in home X,” at “step 1110, the server retrieves the current inside temperature reading as transmitted by the thermostat,” and at step 1112, the server “calculates the likely rate of change for internal temperature in home X from a starting point of 70 degrees when the outside temperature is 85 degrees at 3:00 PM on August 10th … the server accomplishes this by applying a basic algorithm that weighs each of these external variables as well as variables for various characteristics of the home itself (such as size, level of insulation, method of construction, etc.) and data from other houses and environments.” See ’186 patent at Fig. 11.

46. Preferred embodiments in the ’597 patent disclose generating a prediction for the future with a calculation that uses the available historical data stored in the database.

47. For example, the ’567 patent discloses actual values obtained currently or in the past, with the values stored in “temperature database 400.” See ’597 patent at 4:34-40, Fig. 5.

48. The ’597 patent further discloses “comparing outside temperature, inside

temperature, thermostat settings, cycling behavior of the HVAC system," which are all historical values logged in the server's database. See '597 patent at 4:62-5:40; see also '597 patent at Fig. 6 and accompanying text:

> "For example, FIG. 6a shows a graph of inside temperature, outside temperature and HVAC activity for a 24 hour period. When outside temperature 302 increases, inside temperature 304 follows, but with some delay because of the thermal mass of the building, unless the air conditioning 306 operates to counteract this effect. When the air conditioning turns on, the inside temperature stays constant (or rises at a much lower rate or even falls) despite the rising outside temperature. In this example, frequent and heavy use of the air conditioning results in only a very slight temperature increase inside of the house of 4 degrees, from 72 to 7 6 degrees, despite the increase in outside temperature from 80 to 100 degrees. FIG. 6b shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7 PM. As expected, the inside temperature 304a rises with increasing outside temperatures 302 for most of that period, reaching 88 degrees at 7 PM."

49. The '597 patent, at 5:20-34, further discloses (emphasis added):

> "Because server 106 logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. **That performance data will allow the server 106 to calculate an effective thermal mass for each structure—that is, the speed with [which] the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.** The ability to predict the rate of change in inside temperature in a given house under varying conditions may be applied by in effect holding the desired future inside temperature as a constraint and using the ability to predict the rate of change to determine when the HVAC system must be turned on in order to reach the desired temperature at the desired time."

50. These disclosures from the intrinsic evidence are consistent with EcoFactor's proposal and demonstrate that Google's proposal—to the extent it can be understood at this stage, where Google has not yet offered any explanation for it—would exclude disclosed embodiments of the claimed inventions.

51. I have reviewed what Google identifies as "supporting evidence" for its proposal. I do not agree that these materials support Google's position. Indeed, they confirm Google's position is wrong, as these materials show that the preferred embodiments disclose calculations of a predicted rate of change that use historical data as inputs. For example, each patent discloses performing a calculation that uses historical data stored in database 300 to predict the rate at which inside temperature should change for given inside and outside temperatures. See, e.g.,'100 patent at 8:20-38; '186 patent at 8:63-9:9; '597 patent at 5:5-40. Likewise, the '186 patent further discloses performing a calculation that uses historical data stored in database 300 to predict the rate at which inside temperature should change for given inside and outside temperatures. See '186 patent at 10:57-11:19.

52. I also disagree with Google's suggestion that the file history of U.S. Patent No. 8,886,488 or the 11/27/2013 Response to Office Action issued during prosecution of the '186 patent supports Google's position. The patentee distinguished between historical values that already occurred in the past and predicted values that are forecasted to occur in the future. But the patentee did not disclaim the use of current or historical values as inputs to performing a calculation of a predicted rate of change.

53. Google's position misunderstands the difference between determining whether something is a prediction about the future versus determining what inputs to use in order to make the prediction. For example, if Google's argument is that the current or historical temperature logged by the thermostat and the server cannot be a prediction (because it is a current or historical value, not a predicted value), it does not follow that the scope of the claims should exclude the use of the current or historical temperature logged by the thermostat and the server in a calculation that generates a prediction about the future. As an example, the use of the current indoor temperature may be a useful input into the calculation, because the predicted rate of change may vary depending on the initial indoor temperature at the beginning of the time interval for which the prediction applies. Likewise, the use of the historical indoor temperatures and outdoor temperatures would be an important input into the calculation according to the preferred embodiments, because the

predicted rate of change may be calculated based on an equation that expresses the historical relationship between changes in indoor temperature in response to changes in outdoor temperature that are determined from the historical temperature database.

54. Thus, I agree with EcoFactor's proposed construction.

B. "a temperature inside the first location will change in response to changes in outside temperature" / "change of temperatures inside the structure in response to at least changes in outside temperatures" / "changes in temperature inside the structure in response to at least changes in outside temperatures" ('186 patent, claims 1, 8; '100 patent, claims 1, 9; '597 patent, claims 1, 9, 17)

EcoFactor's Proposed Construction	Google's Proposed Construction
No construction necessary; plain and ordinary meaning	Indefinite

55. I agree with EcoFactor's proposal for these claim terms. A POSITA would understand the scope and meaning of each claim term, particularly in light of the surrounding claim language and the intrinsic record. Because these claim terms provide reasonable certainty to a POSITA, they are not indefinite.

56. For example, preferred embodiments of the '100, '186, and '597 patents disclose systems and methods for modeling how the inside temperature within a home changes in response to changes in outside temperature—and demonstrate that this relationship can be expressed mathematically and graphically. In addition to changes in outdoor temperature, the preferred embodiments predict how the use of air conditioning and the thermal mass of the building also influence the changes in inside temperature in response to outdoor temperature. See '100 patent at Fig. 6 and accompanying text:

> "For example, FIG. 6a shows a graph of inside temperature, outside temperature and HVAC activity for a 24 hour period. When outside temperature 302 increases, inside temperature 304 follows, but with some delay because of the thermal mass of the building, unless the air conditioning 306 operates to counteract this effect. When the air conditioning turns on, the inside temperature stays constant (or rises at a much lower rate or even falls) despite the rising outside temperature. In this example, frequent and heavy use of the air conditioning results in only a very slight temperature increase inside of the house of 4 degrees, from 72 to 76 degrees, despite

> the increase in outside temperature from 80 to 100 degrees. FIG. 6b shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7 PM. As expected, the inside temperature 304a rises with increasing outside temperatures 302 for most of that period, reaching 88 degrees at 7 PM."

> Further, the '100 patent, at 7:60-8:38:

> "Because server 106 logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. That performance data will allow the server 106 to calculate an effective thermal mass for each structure—that is, the speed with [which] the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures. The ability to predict the rate of change in inside temperature in a given house under varying conditions may be applied by in effect holding the desired future inside temperature as a constraint and using the ability to predict the rate of change to determine when the HVAC system must be turned on in order to reach the desired temperature at the desired time."

57. There are similar disclosures in the '186 patent, such as the description of "comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system," which are all historical values logged in the server's database. See '186 patent at 8:21-63, Figs. 6-11.

58. The '186 patent, at 8:63-9:9, further discloses:

> "Because server 106a logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. That performance data will allow the server 106a to calculate an effective thermal mass for each structure—that is, the speed with [which] the temperature inside a given building will change in response to changes in outside temperature and differences between inside and outside temperatures. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures."

59. As another example, the '186 patent discloses that at step 1106, the server "retrieves

data regarding recent temperature readings as recorded by the thermostat in home X," at "step 1110, the server retrieves the current inside temperature reading as transmitted by the thermostat," and at step 1112, the server "calculates the likely rate of change for internal temperature in home X from a starting point of 70 degrees when the outside temperature is 85 degrees at 3:00 PM on August 10th … the server accomplishes this by applying a basic algorithm that weighs each of these external variables as well as variables for various characteristics of the home itself (such as size, level of insulation, method of construction, etc.) and data from other houses and environments." See '186 patent at 10:57-11:19, Fig. 11.

60. Similarly, the '597 patent discloses "comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system," which are all historical values logged in the server's database. See '597 patent at 4:62-5:40. For example, in describing Figures 6A and 6B, the '597 patent explains, at 5:5-40:

> "For example, FIG. 6a shows a graph of inside temperature, outside temperature and HVAC activity for a 24 hour period. When outside temperature 302 increases, inside temperature 304 follows, but with some delay because of the thermal mass of the building, unless the air conditioning 306 operates to counteract this effect. When the air conditioning turns on, the inside temperature stays constant (or rises at a much lower rate or even falls) despite the rising outside temperature. In this example, frequent and heavy use of the air conditioning results in only a very slight temperature increase inside of the house of 4 degrees, from 72 to 7 6 degrees, despite the increase in outside temperature from 80 to 100 degrees. FIG. 6b shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7 PM. As expected, the inside temperature 304a rises with increasing outside temperatures 302 for most of that period, reaching 88 degrees at 7 PM. Because server 106 logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. That performance data will allow the server 106 to calculate an effective thermal mass for each structure—that is, the speed with [which] the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures. The ability to predict the rate of change in inside temperature in a given house under varying conditions may be applied by in effect holding the desired future inside temperature as a constraint and using the ability to predict the rate of change to determine when the HVAC

system must be turned on in order to reach the desired temperature at the desired time."

61. Google identified no intrinsic evidence as alleged support for its proposal that these terms and phrases are indefinite.

62. Google has identified one piece of extrinsic evidence, The Facts On File Dictionary of Physics, 4th Ed. 2005 at 168, as allegedly supporting its position but has not yet provided any explanation of its relevance. I disagree with Google's apparent belief that this dictionary shows that the challenged claim terms are indefiniteness.

63. Thus, I agree with EcoFactor's proposed construction.

C. "internal temperature measurements taken within a structure" / "inside temperature measurements" / "outside temperature measurements relating to temperatures outside the structure" / "outside temperature measurements" / "outside temperature measurements" ('100 patent, claims 1, 9; '597 patent, claims 1, 9, 17; '186 patent, claims 1, 8, 9)

EcoFactor's Proposed Construction	Google's Proposed Construction
No construction necessary; plain and ordinary meaning	sensed readings of the ambient temperature inside/outside a structure

64. I agree with EcoFactor's proposal for these claim terms. In multiple cases involving EcoFactor patents, including another case involving the same patents asserted here (*EcoFactor, Inc. v. ecobee, Inc.*, Case No. 6:21-cv-00428-ADA (W.D. Tex.) ("the -00428 Texas Action")), the court has found and/or the parties have agreed that variants of "internal temperature measurements" or "outside temperature measurements" do not require construction and have their plain and ordinary meaning. See, e.g., Ex. C (EcoFactor/ecobee Joint Claim Construction Statement) at 1. Indeed, I further understand that these terms and very similar terms were given their plain and ordinary meaning in *EcoFactor, Inc. v. Google LLC,* Case No. 6:20-cv-0075-ADA (W.D. Tex.) (the "-00075 Texas Action"), *EcoFactor, Inc. v. ecobee, Inc.,* Case No. 6:20-cv-00078-ADA (W.D. Tex.) (the "-00078 Texas Action"), and *EcoFactor, Inc. v. Vivint, Inc.,* Case No. 6:20-cv-00080-ADA (W.D. Tex.) (the "-00080 Texas Action").

65. A person of ordinary skill in the art understands what a "measurement" is, including

what a "temperature measurement" is. For example, measurement is "the process of determining the value of some quantity in terms of a standard unit." See Ex. D (McGraw Hill Dictionary of Scientific and Technical Terms, 4th ed.). In the context of temperature measurements, the standard unit would be degrees Celsius or degrees Fahrenheit, which is commonly understood. There are many ways to take a measurement of temperature, such as by using digital temperature sensors or a mercury thermometer. What defines "measurement" is determining the value of some quantity in terms of a standard unit. For example, the McGraw Hill Dictionary of Scientific and Technical Terms explains that "temperature" (referring to the direction of heat flow when one region is placed in thermal contact with another object) can be "measured either by an empirical temperature scale, based on some convenient property of a material or instrument, or by a scale of absolute temperature, for example, the Kelvin scale." See Ex. D (McGraw Hill Dictionary of Scientific and Technical Terms, 4th ed.).

66. A POSITA would further understand that "measurement" is not limited to any individual reading from a measuring tool or instrument. Rather, measurement refers to any value that is determined in terms of a standard unit, including both the immediate value obtained directly from using a measuring instrument, as well as values determined after correcting for instrument error, accounting for noise, or otherwise improving the accuracy of the measurement process. The McGraw Hill Dictionary of Scientific and Technical Terms also confirms that "temperature error" refers to the instrument error due to non-standard temperature of an instrument. See Ex. D (McGraw Hill Dictionary of Scientific and Technical Terms, 4th ed.). In other words, temperature measurements can be obtained using a variety of tools and techniques, and depending on the specific tools or techniques used, there can be differences in measurement accuracy. A POSITA would readily understand this, would be familiar with the concept of temperature compensation, and would not require further construction of terms such as "temperature measurement" because the plain and ordinary meaning of such terms is already clear.

67. Google's proposed construction adds language (e.g., "ambient") that does not clarify the scope of the claim terms to a POSITA—if anything, it makes the claims more

ambiguous. For example, the term “ambient” does not appear in the specification of the ’100 patent. The “inside temperature” refers to the temperature inside the structure, and “outside temperature” refers to the temperature outside the structure. The use of the term “ambient” does not clarify anything, as the claim language is already clear. In the context of indoor temperature, the term “ambient” does not add clarity at least because one of the preferred embodiments discloses the use of “additional temperature sensors at different locations within the building” which “may allow increased accuracy of the system, which can in turn increase user comfort or energy savings.” ’186 patent at 13:14-21. In that embodiment, the “ambient” temperatures immediately surrounding each temperature sensor may differ, but a person of ordinary skill in the art would nonetheless understand that the “inside temperature measurements” contemplated for the invention can correspond to any of the values obtained from the temperature sensors or a combination of the values that represents some form of weighted average indoor temperature. The point is to obtain an accurate value for the indoor temperature affecting the occupants, and the word “ambient” does not clarify things where the home being modeled will invariably have differences in ambient temperature at different rooms and locations. The term “ambient” also does not add any clarity in the context of “outdoor temperature measurements” because the preferred embodiments disclose the use of an Internet weather service to receive outdoor temperature measurements for the geographic region or location encompassing the home that is being modeled. ’186 patent at 5:12-18; ’100 patent at Fig. 5 (weather database 800); ’597 patent at Fig. 5 (weather database 800). Addition of the term “ambient” could cause confusion, as it may wrongly suggest that the claims can only be met by using, for example, a temperature sensor mounted immediately outside the home/structure—even though that is actually not the preferred embodiment and, at least at some times, would be less accurate than the preferred embodiment (e.g., due to the effects of sunlight at different times of day). The claims are broad enough to include the use of Internet weather services to obtain a more accurate outdoor temperature reading than would be provided by an individual outdoor temperature sensor. The value obtained from the Internet weather service is an outdoor temperature measurement if it is in standard units of degrees Celsius or Fahrenheit.

68. I have reviewed what Google identifies as "supporting evidence" for its proposal. I do not agree that these materials support Google's position. The specifications do not provide any definition (lexicography) for temperature measurements matching Google's proposal, nor has Google identified any evidence that the patentee disclaimed scope in order to limit the claims as Google proposes. As described above, that is clearly not the case because, as one example, the patents contemplate the use of Internet weather services providing outside temperature measurements. Google has not yet explained its position, but by importing language into the claims without a basis in the intrinsic evidence for doing so, it appears that Google is attempting to exclude preferred embodiments from the scope of these claim terms.

69. Thus, I agree with EcoFactor's proposed construction.

D. "the HVAC control system" ('186 patent, claims 1, 8)

EcoFactor's Proposed Construction	Google's Proposed Construction
No construction necessary; plain and ordinary meaning; not means-plus-function and not subject to or governed by §112(6) / §112(f); not indefinite. In the alternative, if governed by §112(6), corresponding structure is server 106, thermostat 108, website 300, and/or combination of server 106, website 300, and/or thermostat 108.	Subject to paragraph 6 of Section 112; indefinite for lack of structure.

70. I agree with EcoFactor's proposal for this claim term because "HVAC control system" has a plain and ordinary meaning that does not require any further construction. An HVAC control system is a system that controls settings for an HVAC system.

71. This claim term is not subject to 35 U.S.C. § 112(6). Because this claim term does not include the word "means," I understand it is presumed that Section 112(6) does not apply. I also understand that the law recognizes that "nonce" words in a claim term may similarly indicate that it should be construed according to Section 112(6), but I am not aware of this claim term ("HVAC control system") ever being considered such a "nonce" term. This claim term connotes structure for performing the claimed functions of "pre-cool[ing] the first structure based on the

one or more predicted rates of change" and "reduc[ing] electricity demand." A control system is a structural element, and a POSITA would understand this claim term to refer to structure. Specifically, a POSITA would understand that an HVAC control system is used to control an HVAC system, which supplies heating or cooling to a structure. Based on different information, an HVAC control system will control the HVAC system to supply appropriate amounts of heating or cooling at particular times. One example of this is when a server computer determines that the HVAC control system should pre-cool a customer's home prior to a period of expected high demand (e.g., a Demand Response event or Time of Use peak rate period) in order to reduce electricity demand during that high-demand period.

72. The class of structures corresponding to "HVAC control system" would be known to a POSITA as including a programmable communicating thermostat, which is a known structure. It would also be known to include a computer server and a website that communicate programming to the connected thermostat, as taught in specification and depicted in the architecture diagram of Figure 2. These are also clearly structural and sufficient to implement the claimed functions because the server and/or website communicates signals to the thermostat regarding temperature setpoints governing when to engage cooling, and the thermostat signals the HVAC system to apply the cooling based on the programming. For example, the specification explains:

> In addition to using the system to allow better signaling and control of the HVAC system, which relies primarily on communication running from the server to the thermostat, the bi-directional communication will also allow the thermostat 108 to regularly measure and send to the server information about the temperature in the building. By comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system, and other variables, the system will be capable of numerous diagnostic and controlling functions beyond those of a standard thermostat.

'186 patent at 8:21-30.

> Because the system will be able to calculate effective thermal mass, it will also be able to determine the cost effectiveness of strategies such as pre-cooling for specific houses under different conditions…the system will recommend that House A pre-cool in order to save money, but not recommend pre-cooling for House B [because of differences in thermal mass between House A and House B].

’186 patent at 9:45-10:5.

73. As further evidence that the term “HVAC control system” would be familiar to a POSITA and not a “nonce” term implicating Section 112(6), I note that Google regularly uses this specific phrase in its own patents. *See, e.g.*, Ex. E (ECO-GOOG_0002287-330, U.S. Pat. No. 10,012,407) at claims 1-10, 12, 14-16, 19-23, 25, 27, 29 (Google patent reciting “HVAC control system” in over 20 claims); Ex. F (ECO-GOOG_0002331-82, U.S. Pat. No. 10,241,482) at claims 13-24 (Google patent reciting “HVAC control system” in over 10 claims); Ex. G (ECO-GOOG_0002429-456, U.S. Pub. No. 2016/0161138) at Title, claims 2-21 (Google patent application reciting “HVAC control system” in title and all claims).

74. The intrinsic evidence further supports EcoFactor’s proposal. For example, the Field of the Invention section of the patent specification explains that this “invention relates to the use of thermostatic HVAC controls that are connected to a computer network. More specifically, communicating thermostats are combined with a computer network to calculate the thermal mass of a structure.” E.g., ’186 patent at 1:22-26. A person of ordinary skill in the art at the time of this invention would understand that this description refers to one or more HVAC control systems.

75. One example of an HVAC control system would be a thermostat, such as an electronic, programmable communicating thermostat. For example, the background section of the patent specification explains that HVAC systems “have been controlled for decades by thermostats.” ’186 patent at 1:28-45. Basic thermostats include a “means to signal the heating and/or cooling devices to turn on or off,” such as a “coiled bi-metallic spring to measure actual temperature and a mercury switch that opens or completes a circuit when the spring coils or uncoils with temperature changes.” ’186 patent at 1:28-45. Meanwhile, “electronic digital thermostats” use “thermistors or thermal diodes to measure temperature, and microprocessor-based circuitry to control the switch and to store and operate based upon user-determined protocols for temperature vs. time.” ’186 patent at 1:28-45.

76. The patent specification describes embodiments which include “at least one HVAC

control system that measures temperature at at least a first location conditioned by said HVAC system, and reporting said temperature measurements as well as the status of said HVAC system." '186 patent at 3:66-4:3. This is consistent with the understanding of a POSITA that an HVAC control system can correspond to a programmable communicating thermostat that measures temperature using one or more temperature sensors, thermistors, or the equivalent, and that reports said temperature measurements as well as the status of the HVAC system to a computer. This is one example of an embodiment that would be consistent with claim 1 of the '186 patent.

77. Another example of an HVAC control system would be a programmable communicating thermostat that controls the temperature settings for an HVAC system in combination with one or more computers. The patent specification explains that a standard programmable thermostat can be improved upon through the addition of additional HVAC control features that are supported by one or more computers:

> More specifically, communicating thermostats are combined with a computer network in order to evaluate changes in the operational efficiency of an HVAC system over time.

'186 patent at 1:22-26.

> It would therefore be advantageous for a thermostat system to automatically incorporate information about external weather conditions when setting the desired temperature.

'186 patent at 2:16-19.

> But the 'signature' of each different problem can be discerned from the way in which each such problem affects the cycle times of a given HVAC system over time and relative to weather conditions… Because the cycling of the HVAC system is controlled by the thermostat, those differences in cycle time would be reflected in the data sensed by and control signals generated by the thermostat. It would be advantageous for a thermostat system to be able to use that information to diagnose problems and make recommendations based upon that data.

'186 patent at 3:45-63; see also '186 patent at 3:64-5:3 (describing numerous embodiments including "one or more processors" and one or more thermostatic controls that together evaluate the operational efficiency of an HVAC system over time).

> In at least one embodiment, the invention comprises a thermostat attached to an HVAC system, a local network connecting the thermostat to a larger network such

> as the Internet, and one or more additional thermostats attached to the network, and a server in bi-directional communication with a plurality of such thermostats. The server logs the ambient temperature sensed by each thermostat vs. time and the signals sent by the thermostats to their HVAC systems. The server preferably also logs outside temperature and humidity data for the geographic locations for the buildings served by the connected HVAC systems. Such information is widely available from various sources that publish detailed weather information based on geographic areas such as by ZIP code… Combining these data sources will also allow the server to calculate the effective thermal mass of the structures conditioned by those thermostats. By combining data from multiple thermostats in a given neighborhood, the system can correct for flaws in the location of a given thermostat, and can evaluate the efficiency of a given system, as well as assist in the diagnosis of problems and malfunctions in such systems.

’186 patent at 5:4-30.

78. Another example of an HVAC control system would be a computer server that controls the temperature settings for an HVAC system. The patent specification describes embodiments in which the “HVAC control system” is a server that communicates with a thermostat. For example, the specification explains that for at least one embodiment:

> In addition to using the system to allow better signaling and control of the HVAC system, which relies primarily on communication running from the server to the thermostat, the bi-directional communication will also allow the thermostat 108 to regularly measure and send to the server information about the temperature in the building. By comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system, and other variables, the system will be capable of numerous diagnostic and controlling functions beyond those of a standard thermostat.

’186 patent at 8:21-30.

79. This shows that in at least one embodiment, an HVAC control system that receives temperature measurements and the status of an HVAC system is a server that receives this information from a connected thermostat. This is another example of an embodiment that would be consistent with the claims of the ’186 patent. I note that claims 1 and 8 recite “one or more server computers” that “determin[e] whether to direct the HVAC control system to pre-cool the first structure based on the one or more predicted rates of change prior to directing the HVAC control system to reduce electricity demand.” ’186 patent at claims 1, 8. To the extent Google

suggests that this claim language means that "HVAC control system" cannot include any server computer (because a server computer would not direct itself to do something), I would disagree. It is common to use multiple server computers that communicate with one another (such that one server computer could direct another server computer to do something).

80. Still another example of an HVAC control system would be a combination of the foregoing examples. A POSITA would understand how to combine one or more HVAC control systems/components and how to implement a multi-component system that itself qualifies as an HVAC control system and includes components that themselves qualify as HVAC control systems. For example, a computer server in combination with two programmable communicating thermostats that are each connected to two different HVAC systems can be understood as a single HVAC control system that can control the settings of two different HVAC systems, or as a combination of an HVAC control system embodied in the server together with two HVAC control systems embodied in the two programmable communicating thermostats.

81. A POSITA would understand that computers or computer servers in combination with a website or web application can also qualify as an HVAC control system. For example, in at least one preferred embodiment, there is an HVAC control system that corresponds to "server 106 [which] contains content to be served as web pages and viewed by computers 104." '186 patent at 7:14-8:9. Website 200 includes "components accessible to the user," including "means to enter temperature settings 202." '186 patent at 7:14-8:9. Further, "website 200 will permit thermostat users to perform through the web browser substantially all of the programming functions traditionally performed directly at the physical thermostat, such as temperature set points, the time at which the thermostat should be at each set point, etc. Preferably the website will also allow users to accomplish more advanced tasks such as allow users to program in vacation settings for times when the HVAC system may be turned off or run at more economical settings, and set macros that will allow changing the settings of the temperature for all periods with a single gesture such as a mouse click." '186 patent at 8:10-20. Because server 106 allows users to control the HVAC system through website 200, the specification explains that the "thermostat 250 may also include controls

266 allowing users to change settings directly at the thermostat, but such controls are not necessary to allow the thermostat to function." '186 patent at 7:55-58.

82. I disagree with Google that the term "HVAC control system" is governed by Section 112(6). But even if the court were to make that determination, the claims would still provide reasonable certainty to a POSITA. This is because the specification provides sufficient structure corresponding to the claimed functions, as detailed above. A POSITA would understand with reasonable certainty the scope of this claim term, including with reference to the numerous embodiments and claims I have described above.

83. I have reviewed what Google identifies as "supporting evidence" for its proposal. I do not agree that these materials support Google's position. Google first identifies the Abstract of the '186 patent as alleged support for its position. It is unclear why Google believes this shows that "HVAC control system" should be construed according to Section 112(6) and found indefinite. Google's only other cited evidence (3:64-5:5) also does not show that this claim term should be subject to Section 112(6) or that, if it is, that the specification lacks corresponding structure for the claimed functions. Instead, as described above, this portion of the specification describes numerous embodiments including "one or more processors" and one or more thermostatic controls that together evaluate the operational efficiency of an HVAC system over time. These disclosures support EcoFactor's proposal—not Google's.

84. Thus, I agree with EcoFactor's proposed construction.

E. "rapid cycling" ('890 patent, claim 1)

EcoFactor's Proposed Construction	Google's Proposed Construction
No construction necessary; plain and ordinary meaning	Indefinite

85. I agree with EcoFactor's proposal for this claim term because it has a plain and ordinary meaning that does not require any further construction. In light of the intrinsic evidence and the knowledge of one of ordinary skill, a POSITA would have reasonable certainty as to the scope and meaning of this claim term. It is not indefinite.

86. According to its December 6, 2021 disclosure, Google asserts that "rapid cycling" is indefinite because "rapid" is a "subjective term of degree." I understand that numerical precision is not required for patent claims and that terms of degree are permissible in patent claims. A POSITA would readily understand what is meant by "rapid cycling," which is also sometimes referred to as "short cycling." The specification explains what rapid cycling is, how it can negatively impact the HVAC system and use energy inefficiently, and how thermostats commonly use a "hysteresis zone" or "dead zone" around a customer's temperature setpoint to help protect against rapid cycling:

> Because most thermostats control HVAC systems that do not offer infinitely variable output, traditional thermostats are designed to permit the temperature as seen by the thermostat to vary above and below the setpoint to ***prevent the HVAC system from constantly and rapidly cycling on and off,*** which is inefficient and harmful to the HVAC system. The temperature range in which the thermostat allows the controlled environment to drift is known as both the ***dead zone*** and, more formally, the ***hysteresis zone***. The hysteresis zone is ***frequently set at +/−1 degree*** Fahrenheit. Thus if the setpoint is 68 degrees, in the heating context the thermostat will allow the inside temperature to fall to 67 degrees before turning the heating system on, and will allow it to rise to 69 degrees before turning it off again.

'890 patent at 2:5-18 (emphasis added).

87. For any given home and HVAC system, the inside temperature will generally change after the HVAC system cycles off, particularly if there is a significant difference between the inside temperature and outside temperature. How long it will take for the temperature change from, for example, 68º F to 69º F after the air conditioning cycles off is impacted by the outside temperature. For example, the inside temperature might increase by one degree more quickly after the AC cycles off if it is 95º F outside than if it is only 73º F outside:

> The greater the amount by which outside temperature exceeds inside temperature in the air conditioning context, the more rapidly the inside temperature will increase during an off cycle, and the slower the air conditioner will be able to cool during the on cycle.

'890 patent at 20:24-28.

88. As described in the specification and as further discussed above, HVAC systems

can also impose a compressor delay, including with a hysteresis zone. See, e.g., '890 patent at 19:21-20:38. The specification provides a series of examples in which compressor delays of varying lengths are provided to protect against rapid cycling. For example, the specification describes a compressor delay of three minutes with respect to Figure 21a and a delay of eight minutes with respect to Figures 21B and 21C. See, e.g., '890 patent at 19:46-20:35, Figs. 20, 21A, 21B, 21C. Claim 1 is not limited to any specific number of minutes that would constitute a "rapid cycling," though disclosures such as these in the specification indicate what generally may be considered a rapid cycle for a given HVAC system.

89. I also note that terms like "rapid cycling" and "short cycling" are commonly used in the field of HVAC control. For example, smart thermostat providers like Google itself, as well as ecobee, use such terminology in their patents and on their websites. See, e.g., Ex. H at 24:23-27 (ECO-GOOG_0002383, Google patent stating (emphasis added): "The maintenance band 1106 may be a form of hysteresis **to prevent the rapid cycling of the HVAC system** as the temperature drifts around the setpoint temperature 1120."); Ex. I at 16:53-59 (ECO-GOOG_0002491, Google patent stating (emphasis added): "Although some HVAC components, such as many AC compressors, have a built in "lock out" feature that **prevents rapid cycling**, not all components have such protection. … In such cases the delay such as in steps 812 and/or 816 are useful in **preventing rapid cycling of HVAC** components that are otherwise unprotected."); Ex. J (ECO-GOOG_0002263, Google Nest help search results for "short cycling"); Ex. K ¶ 88 (ECO-GOOG_0002457, ecobee patent application stating (emphasis added): "In practice, using a larger humidex value will **reduce the short-cycling** of HVAC system 20, which is harder on the equipment and is generally less efficient heating and cooling."); Ex. L at 4, 5, 6 (ECO-GOOG_0002246, ecobee webpage stating (emphasis added): "This setting **prevents your equipment from short cycling**."; "This setting **prevents your equipment from short cycling** and helps to conserve energy."; "This setting **prevents your compressor from short cycling** … .").

90. It is not only Google and ecobee that use such terminology in their patents and

webpages. For example, a Carrier patent that names as its inventor Google's IPR expert, Rajendra K. Shah (including for its IPR petition challenging the '890 patent) states (emphasis added): "Some temperature "dead band" or "hysteresis", such as the exemplary half degree in each direction, is typically applied to **prevent rapid cycling** of the heating or cooling equipment." Ex. M at 1:31-34 (ECO-GOOG_0002418, Carrier patent). Websites describing HVAC repair and thermostats also commonly use the phrase "rapid cycling," as this is a known term in the field of HVAC control. See, e.g., Ex. N at 1 (ECO-GOOG_0002268, HVAC repair webpage stating (emphasis added): "A serious issue that air conditioners can encounter is '**rapid cycling**' or 'short cycling.' This is when the compressor, the core of the cooling power in an AC and the component that requires the most power to run, turns on for only a short period before shutting down again, long before finishing its cooling cycle. A brief time later, the compressor will turn back on and start the process over."); Ex. O at 7 (ECO-GOOG_0002271, thermostat review webpage comparing Google and ecobee thermostats and stating (emphasis added): "This sort of **rapid cycling** can reduce energy efficiency, reducing the effectiveness of the thermostat overall.").

91. Examples such as these further demonstrate that the meaning of "rapid cycling" would be reasonably certain to a POSITA in the field of the '890 patent. It is a term commonly used and understood in the field of HVAC control without requiring any specific numerical limit—as reflected in Google's own patents, those of its IPR expert, and a multitude of other patents and webpages relating to HVAC control. This claim term is not indefinite.

92. I also note that Google's competitor, ecobee, also made this indefiniteness argument in the -00428 Texas Action involving the same '890 patent. I understand the court rejected that argument and adopted EcoFactor's proposal of "No construction necessary; plain and ordinary meaning," the same proposal EcoFactor offers here.

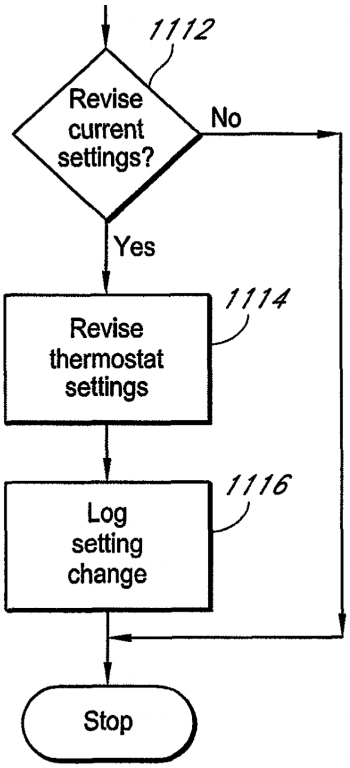
93. Thus, I agree with EcoFactor's proposed construction.

F. "setpoint" / "setpoints" / "one or more setpoints" ('597 patent, claims 1, 9, 17)

EcoFactor's Proposed Construction	Google's Proposed Construction
"a temperature setting for a thermostat to achieve or maintain"	indoor temperature value for a thermostat to achieve and maintain

94. I agree with EcoFactor's proposal for these claim terms. In multiple cases involving EcoFactor patents, including the -00428 Texas Action involving the same '597 patent, the court has found and/or the parties have agreed that the term "setpoint" means "a temperature setting for a thermostat to achieve or maintain." See, e.g., Ex. C (EcoFactor/ecobee Joint Claim Construction Statement) at 1. I also note that in a recent ITC investigation involving U.S. Patent No. 8,596,550 ("the '550 patent"), Google agreed with EcoFactor that the claim term "setpoint" means "a temperature setting for a thermostat to achieve or maintain," as reflected in the Markman Order entered by the ALJ. See Ex. B (1258 Markman Order) at 17. The '597 patent asserted here is a continuation of—and shares the same specification as—the '550 patent asserted in that ITC investigation.

95. The intrinsic evidence is consistent with EcoFactor's proposed construction. For example, in describing Figure 8 (excerpted below), the specification explains:



"In step 1112 the server determines whether to alter the current setpoint as a result of applying the rules in step 1110. If no setpoint change is indicated, then the server proceeds to step 1118. If a setpoint change is indicated, then in step 1114 the server transmits the setpoint change to the thermostat, and in step 1116 it records that change to one or more databases in overall database structure 300." '597 patent at 6:63-7:2.

96. As shown in Figure 8, the specification uses the term "thermostat settings" in describing setpoints, which is consistent with EcoFactor's proposal. Google's proposed construction may be intended to limit the scope of a setpoint solely to a temperature value (e.g., 72 degrees F), but a POSITA would appreciate that setpoints are thermostat settings with time and temperature components. I note that Google's own patents acknowledge this. *See, e.g.*, Ex. P (ECO-GOOG_0002536, U.S. Pat. No. 9,552,002) at 4:14-22 (Google patent describing temperature and time of day components of setpoints).

97. I have reviewed what Google identifies as "supporting evidence" for its proposal. I do not agree that these materials support Google's position. Google did not identify any portions of the prosecution history but identified the following portions of the specification: '597 patent at 1:26-31, 5:58-6:30; 6:52-63, Fig. 9. Because the specification of the '597 patent is identical to the specification of the '550 patent—for which Google agreed that "setpoint" means what EcoFactor

proposes here—it is unclear why Google thinks "setpoint" should have a different meaning for the '597 patent than for the '550 patent. Nothing in the portions of the specification identified by Google indicates that "setpoint" must be limited to an "indoor temperature value," as Google is now proposing. Neither the specification nor the prosecution history provides any lexicography or disclaimer supporting Google's construction.

98. Thus, I agree with EcoFactor's proposed construction, which is the same construction previously agreed to by Google and others.

G. "evaluate one or more parameters including at least the outside temperature measurements and the predicted rate of change" / "evaluating the one or more parameters comprises evaluating at least the outside temperature measurements and the predicted rate of change" ('100 patent, claims 1, 9)

EcoFactor's Proposed Construction	Google's Proposed Construction
No construction necessary; plain and ordinary meaning	Indefinite

99. I agree with EcoFactor's proposal for these claim terms because they have plain and ordinary meanings that do not require any further construction. In light of the intrinsic evidence, a POSITA would have reasonable certainty as to the scope and meaning of these claim terms. They are not indefinite.

100. The claim language surrounding these terms provides valuable context and clarity as to the scope of the claims. For example, claim 1 recites:

> a computer processor in communication with said thermostatic controller, the processor configured to: …
>
> evaluate one or more parameters including at least the outside temperature measurements and the predicted rate of change, and to determine whether to adopt said first interval or said second interval based upon the values of said parameters.

'100 patent at cl. 1.

101. This limitation further clarifies that the rate of change is predicted using stored inside temperature measurements and outside temperature measurements. In other words, the claim language itself indicates which parameters at least are evaluated, how the result of the

evaluation is used, and that computer hardware that is configured to perform the evaluation. The same is true for claim 9:

> evaluating, with at least one computer processor, one or more parameters relating to the operation of the said ventilation system, wherein the computer processor:
>
> > accesses stored data comprising a plurality of internal temperature measurements taken within a structure and a plurality of outside temperature measurements relating to temperatures outside the structure;
> >
> > uses the stored data to predict a rate of change of temperatures inside the structure in response to at least changes in outside temperatures; and
> >
> > wherein evaluating the one or more parameters comprises evaluating at least the outside temperature measurements and the predicted rate of change;
>
> determining which of at least a first interval and a second interval is to be enforced as a delay by said thermostatic controller in light of at least the outside temperature measurements and the predicted rate of change, wherein said second interval is longer than said first interval

’100 patent at cl. 9.

102. This is also consistent with the specification, which explains, for example:

> FIG. 7 shows a flowchart illustrating the steps required to initiate a compressor delay adjustment event. In step 1102, server 106 retrieves parameters such as weather conditions, the current price per kilowatt-hour of electricity, and the state of the electric grid in terms of supply versus demand for the geographic area that includes a given home. In step 1104 server 106 determines whether to instantiate the compressor delay adjustment program for certain homes in response to those conditions. In step 1106, server 106 determines whether a specific home is subscribed to participate in compressor delay events. If a given home is eligible, then in step 1108 the server retrieves the parameters needed to specify the compressor delay routine. These may include user preferences, such as the weather, time of day and other conditions under which the homeowner has elected to permit hysteresis band changes, the maximum length of compressor delay authorized, etc. In step 1110 the appropriate compressor delay settings are determined, and in step 1112 the chosen settings are communicated to the thermostat.
>
> FIGS. 8(a) through 8(c) illustrate how changes in compressor delay settings affect HVAC cycling behavior by plotting time against temperature. In FIG. 8(a), time is shown on the horizontal axis 1202, and temperature is shown on vertical axis 1204. The setpoint for thermostat 108 is 70 degrees F., which results in the cycling behavior shown for inside temperature 1206. Because compressor delay CD1 1208 is, at approximately 3 minutes, shorter than the natural duration of a compressor off

> cycle Off1 1210 at approximately 6 minutes for this particular house under the illustrated conditions, the compressor delay has no effect on the operation of the HVAC system. Because the hysteresis band operates so as to maintain the temperature within a range of plus or minus one degree of the setpoint, in the case of air conditioning the air conditioner will switch on when the inside temperature reaches 71 degrees, continue operating until it reaches 69 degrees, then shut off. The system will then remain off until it reaches 71 degrees again, at which time it will switch on. The percentage of time during which inside temperature is above or below the setpoint will depend on conditions and the dynamic signature of the individual, home. Under the conditions illustrated, the average inside temperature AT1 1212 is roughly equal to the setpoint of 70 degrees.
>
> FIG. 8(b) shows how with the same environmental conditions as in FIG. 8(a), the cycling behavior of the inside temperature changes when the compressor delay is longer than the natural compressor off cycle Off1 1210. Extended compressor delay CD2 1214 allows inside temperature 1216 to climb above the range normally enforced by the hysteresis band. Because CD2 is roughly 8 minutes, under the given conditions the inside temperature climbs to approximately 72 degrees before the compressor delay allows the air conditioner to restart and drive the inside temperature back down. But as before, the air conditioner shuts off when the inside temperature reaches 69 degrees. Thus the average temperature is increased from AT1 1212 to AT2 1218. This change will save energy and reduce cycling because it takes less energy to maintain a higher inside temperature with an air conditioner
>
> FIG. 8(c) shows how the same compressor delay can result in different thermal cycling with different weather conditions. The greater the amount by which outside temperature exceeds inside temperature in the air conditioning context, the more rapidly the inside temperature will increase during an off cycle, and the slower the air conditioner will be able to cool during the on cycle. Thus as compared to FIG. 8(b), when the inside temperature increased to roughly 72 degrees during the extended compressor delay of 8 minutes, a higher outside temperature will cause the inside temperature to increase faster, which results in a peak temperature of roughly 73 degrees, and in wider temperature cycling 1220. The average inside temperature consequently increases from AT(2) 1218 to AT(3) 1222.

’100 patent at 8:39-9:44, Figs. 7, 8a, 8b, 8c.

103. A POSITA would understand the relationship between outside temperature and predicted rate of change, especially given the teachings of the specification. The specification describes and shows “how changes in compressor delay settings affect HVAC cycling behavior by plotting time against temperature” and “how the same compressor delay can result in different thermal cycling with different weather conditions,” given that “[t]he greater the amount by which outside temperature exceeds inside temperature in the air conditioning context, the more rapidly

the inside temperature will increase during an off cycle, and the slower the air conditioner will be able to cool during the on cycle." '100 patent at 8:58-60, 9:31-37. Knowing the outside temperature and the predicted rate of change of inside temperature in response to outside temperature changes allows for the prediction of inside temperature. With this information, a delay interval can be more intelligently selected because factors such as the outside temperature being much hotter or colder than the inside temperature or the predicted rate of change being very high or very low will impact the determination of which delay interval is most appropriate for a given HVAC system. A POSITA would appreciate such considerations and be able to appropriately evaluate relevant factors including at least outside temperature and predicted rate of change. Especially in light of the claims themselves and the specification of the '100 patent, the scope and meaning of claims 1 and 9 would be reasonably certain to a POSITA.

104. I also note that Google's competitor, ecobee, also made this indefiniteness argument in the -00428 Texas Action involving the same '100 patent. I understand the court rejected that argument and adopted EcoFactor's proposal of "No construction necessary; plain and ordinary meaning," the same proposal EcoFactor offers here.

105. Thus, I agree with EcoFactor's proposed construction.

I declare under penalty of perjury that the foregoing is true and correct.

Executed April 4, 2022.

By: ______________________

Robert Zeidman